



SOLVAY MINERALS

AM
Bernie



March 11, 2003

Bernie Dailey
WDEQ-Air Quality Division
122 W. 25th Street
Cheyenne, WY 82002

RE: Solvay 1986 and 1987 NO_x Emissions

Dear Bernie:

Per our recent conversation, following are the actual NO_x emissions for the Solvay Minerals (formerly Tenneco Minerals) facility near Green River during 1986 and 1987. We had three NO_x emission point sources at that time, Calciners A&B common stack, AQD #17; Boiler #1, AQD #18; and Boiler #2, AQD #19. Actual emissions, per the annual Emission Inventories submitted to WDEQ are tabulated below:

Actual 1986 NO _x emissions based on 1986 Emissions Inventory (tested pph)				
AQD #	Actual PPH	Operating hours	TPY	Date of last test
17	160.9	8500	683.8	3/83
18	170.2	7827	666.1	4/84
19	160.2	6053	484.8	2/84

Actual 1987 NO _x emissions based on 1987 Emissions Inventory (tested pph)				
AQD #	Actual PPH	Operating hours	TPY	Date of last test
17	160.9	8548	687.7	3/83
18	170.2	8288	705.3	4/84
19	160.2	8363	669.9	2/84

The actual emissions in the tables above are based on, what was then, the latest stack test results in pounds per hour (pph). Currently, annual emissions for the calciners and boilers are based on tested lb/MMBtu data and CEM data, respectively. It would be difficult to recreate the actual emissions for the boilers during those years from the CEM data. However, in reviewing the 1984 stack test results, it was found that during testing, AQD #18 was emitting 0.58 lb NO_x/MMBtu, and AQD #19 was emitting 0.54 lb NO_x/MMBtu. The 1983 stack test results for AQD #17 did not include lb NO_x/MMBtu data, nor the amount of coal burned during the test. However, based on both the 1986 and 1987 annual tonnages of coal burned in the calciners and amount of trona fed to the calciners, a factor of 1.4 MMBtu/ton ore was calculated. This factor was used to estimate lb NO_x/MMBtu for AQD #17. The following table was derived by applying those

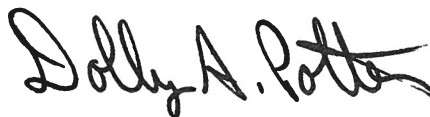
lb NO_x/MMBtu emission factors to the reported heat content and tons of coal burned during 1986 and 1987:

Actual 1986 NO _x emissions based on tested lb/MMBtu				
AQD #	Tons Coal	Btu/lb	lb/MMBtu	TPY
17	106,300	9800	0.62	645.9
18	84,900	9800	0.58	482.6
19	66,700	9800	0.54	353.0

Actual 1987 NO _x emissions based on tested lb/MMBtu				
AQD #	Tons Coal	Btu/lb	lb/MMBtu	TPY
17	118,075	9800	0.62	717.4
18	84,100	9800	0.58	478.0
19	66700	9800	0.54	353.0

Copies of pertinent pages of the emissions inventories, test results, and raw data used to develop this report are enclosed. If you have any questions, please don't hesitate to contact me at (307) 872-6571.

Respectfully submitted,
SOLVAY MINERALS



Dolly A. Potter
Environmental Services Supervisor

Enclosures

cc: Tony Hoyt



April 16, 1987

Mr. Mike Stoll
Compliance Officer
Department of Environmental Quality
Air Quality Division
122 West 25th Street
Cheyenne, Wyoming 82002

Dear Mr. Stoll:

Enclosed are two copies of Tenneco Minerals Company's 1986 Emissions Inventory. If you have any questions, please contact me.

Sincerely,

TENNECO MINERALS COMPANY

A handwritten signature in cursive script, appearing to read "M. S. Litus", with a long horizontal flourish extending to the right.

M. S. Litus
Environmental Engineer

MSL:drf

Enclosures

bcc: R. A. Hodgson
E. W. Mortensen/W. D. Newlin

SOLVAY2016_1.3_000472

PROCESS SOURCE

Unit Identification No. EP-1, 2Year of Record 1986Unit Description CalcinersDate Installed 1981

Process Throughput (Design) 227 Ton/hr 1,688,000 Ton/yr
 (Actual) 176 Ton/hr 1,498,500 Ton/yr

In Process Fuel (If Applicable)

Actual Fuel Combustion for the Year for Unit

	Amount	Heat Content	Sulfur Content	Ash Content
Coal	<u>106,300</u> Ton/yr	<u>9800</u> Btu/lb	<u>0.5</u> %	<u>8</u> %
Fuel Oil	<u> </u> Gal/yr	<u> </u> Btu/gal	<u> </u> %	<u> </u> %
Nat. Gas	<u> </u> 10 ⁶ SCF	<u> </u> Btu/ft ³	<u> </u> %	<u> </u> %
Other	<u> </u> ()	<u> </u> ()	<u> </u> %	<u> </u> %

Operating Parameters:

Operated 24 hr/day, 7 days/wk, 52 wks/yr.Total Operating Hours This Year 8500Average Load This Year (% Capacity) 89Percent Annual Load: Winter 89 Spring 89 Summer 89 Fall 89

Stack Parameters and Control Equipment:

Stack Height	<u>180.5</u>	Feet
Stack Diameter	<u>12</u>	Feet
Stack Velocity	<u>58.4</u>	Feet/sec
Stack Temperature	<u>370</u>	F
Flow Rate	<u>396,300</u>	ACFM

Control Equipment Description: Primary (2) Buell Electrostatic PrecipitatorsSecondary

Emission Data:

	lb/hr	TPY	Method of Determination	Date of Latest Test
Particulate	<u>15.6</u>	<u>66.3</u>	<u>Method 5</u>	<u>3/83</u>
Sulfur Dioxide	<u>0</u>	<u>0</u>	<u>" 6</u>	<u>3/83</u>
Nitrogen Oxides	<u>160.9</u>	<u>683.8</u>	<u>" 7</u>	<u>3/83</u>
Carbon Monoxide	<u>21.0</u>	<u>89.3</u>	<u>Allowable rate</u>	<u>N/A</u>
NMHC	<u>6.0</u>	<u>25.5</u>	<u>Allowable rate</u>	<u>N/A</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

(NMHC is Non-Methane Hydrocarbons)

FUEL COMBUSTION SOURCE

Unit Identification No. 45-7 Year of Record 1986

Unit Description No. 1 Boiler

Date Installed 1981

Design Firing Rate (Million Btu/hr) 350

For Compressors Only, List Design Horsepower _____

Actual Fuel Combustion for the Year for Unit:

	Amount	Heat Content	Sulfur Content	Ash Content
Coal	<u>84,900</u> Ton/yr	<u>9800</u> Btu/lb	<u>0.5</u> %	<u>8</u> %
Fuel Oil	_____ Gal/yr	_____ Btu/gal	_____ %	_____ %
Nat. Gas	_____ 10 ⁶ SCF	_____ Btu/ft ³	_____ %	_____ %
Other	_____ ()	_____ ()	_____ %	_____ %

Operating Parameters:

Operated 24 hr/day, 7 days/wk, 52 wks/yr.

Total Operating Hours This Year 7827

Average Load This Year (% Capacity) 71

Percent Annual Load: Winter 62 Spring 62 Summer 83 Fall 75

Stack Parameters and Control Equipment:

Stack Height	<u>180.5</u>	Feet
Stack Diameter	<u>6</u>	Feet
Stack Velocity	<u>84</u>	Feet/sec
Stack Temperature	<u>125</u>	F
Flow Rate	<u>142,800</u>	ACFM

Control Equipment Description: Primary Flakt Electrostatic Precipitator

Secondary Flakt Spray Tower Absorber

Emission Data:

	lb/hr	TPY	Method of Determination	Date of Latest Test
Particulate	<u>8.9</u>	<u>34.8</u>	<u>Method 5</u>	<u>7/83</u>
Sulfur Dioxide	<u>5.8</u>	<u>22.7</u>	<u>" 6</u>	<u>8/83</u>
Nitrogen Oxides	<u>170.2</u>	<u>666.1</u>	<u>" 7</u>	<u>4/84</u>
Carbon Monoxide	<u>17.5</u>	<u>68.5</u>	<u>Allowable rate</u>	<u>N/A</u>
NMHC	<u>0.5</u>	<u>2.0</u>	<u>Allowable rate</u>	<u>N/A</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

(NMHC is Non-Methane Hydrocarbons)

FUEL COMBUSTION SOURCE

Unit Identification No. WS-8

Year of Record 1986

Unit Description No. 2 Boiler

Date Installed 1981

Design Firing Rate (Million Btu/hr) 350

For Compressors Only, List Design Horsepower _____

Actual Fuel Combustion for the Year for Unit:

	Amount	Heat Content	Sulfur Content	Ash Content
Coal	<u>66,700</u> Ton/yr	<u>9800</u> Btu/lb	<u>0.5</u> %	<u>8</u> %
Fuel Oil	_____ Gal/yr	_____ Btu/gal	_____ %	_____ %
Nat. Gas	_____ 10 ⁶ SCF	_____ Btu/ft ³	_____ %	_____ %
Other	_____ ()	_____ ()	_____ %	_____ %

Operating Parameters:

Operated 24 hr/day, 7 days/wk, 52 wks/yr.

Total Operating Hours This Year 6053

Average Load This Year (% Capacity) 65

Percent Annual Load: Winter 63 Spring 60 Summer 66 Fall 71

Stack Parameters and Control Equipment:

Stack Height	<u>180.5</u>	Feet
Stack Diameter	<u>6</u>	Feet
Stack Velocity	<u>88</u>	Feet/sec
Stack Temperature	<u>120</u>	F
Flow Rate	<u>149,000</u>	ACFM

Control Equipment Description: Primary Flakt Electrostatic Precipitator

Secondary Flakt Spray Tower Absorber

Emission Data:

	lb/hr	TPV	Method of Determination	Date of Latest Test
Particulate	<u>9.6</u>	<u>29.1</u>	<u>Method 5</u>	<u>2/83</u>
Sulfur Dioxide	<u>17.3</u>	<u>52.4</u>	<u>" 6</u>	<u>2/83</u>
Nitrogen Oxides	<u>160.2</u>	<u>484.8</u>	<u>" 7</u>	<u>2/84</u>
Carbon Monoxide	<u>17.5</u>	<u>53.0</u>	<u>Allowable rate</u>	<u>N/A</u>
NMHC	<u>0.5</u>	<u>1.5</u>	<u>Allowable rate</u>	<u>N/A</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

(NMHC is Non-Methane Hydrocarbons)



April 4, 1988

Mr. Dan Olson
Compliance Officer
Department of Environmental Quality
Air Quality Division
122 West 25th Street
Cheyenne, Wyoming 82002

Dear Mr. Olson:

Two copies of Tenneco Minerals Company's 1987 Emissions Inventory are enclosed.

During our 1987 Annual Inspection, Lee Gribovicz asked that we include a brief summary of how the hours of operation for the emissions inventory are calculated. This information has been included as well.

If you have any questions, please contact me.

Sincerely,

TENNECO MINERALS COMPANY

A handwritten signature in cursive script that reads "M. S. Litus".

M. S. Litus
Environmental Engineer

MSL:drf

Enclosures

bcc: R. A. Hodgson
W. D. Newlin/E. W. Mortensen

SOLVAY2016_1.3_000477

PROCESS SOURCE

Unit Identification No. EP-1, 2

Year of Record 1987

Unit Description Calciners

Date Installed 1981

Process Throughput (Design) 227 Ton/hr 1,688,000 Ton/yr
(Actual) 197 Ton/hr 1,683,000 Ton/yr

In Process Fuel (If Applicable)

Actual Fuel Combustion for the Year for Unit

	Amount	Heat Content	Sulfur Content	Ash Content
Coal	Ton/yr	Btu/lb	%	%
Fuel Oil	Gal/yr	Btu/gal	%	%
Nat. Gas	10 ⁶ SCF	Btu/ft ³	%	%
Other	()	()	%	%

Operating Parameters:

Operated 24 hr/day, 7 days/wk, 52 wks/yr.

Total Operating Hours This Year 8548

Average Load This Year (% Capacity) 99.7

Percent Annual Load: Winter 95 Spring 94 Summer 103 Fall 107

Stack Parameters and Control Equipment:

Stack Height	<u>180.5</u>	Feet
Stack Diameter	<u>12</u>	Feet
Stack Velocity	<u>58.4</u>	Feet/sec
Stack Temperature	<u>370</u>	F
Flow Rate	<u>396,300</u>	ACFM

Control Equipment Description: Primary (2) Buell Electrostatic Precipitators

Secondary _____

Emission Data:

	lb/hr	TPY	Method of Determination	Date of Latest Test
Particulate	<u>15.6</u>	<u>66.7</u>	<u>Method 5</u>	<u>3/83</u>
Sulfur Dioxide	<u>0</u>	<u>0</u>	<u>Method 6</u>	<u>3/83</u>
Nitrogen Oxides	<u>160.9</u>	<u>687.7</u>	<u>Method 7</u>	<u>3/83</u>
Carbon Monoxide	<u>21.0</u>	<u>89.8</u>	<u>Allowable rate</u>	<u>N/A</u>
NMHC	<u>6.0</u>	<u>25.6</u>	<u>Allowable rate</u>	<u>N/A</u>

(NMHC is Non-Methane Hydrocarbons)

FUEL COMBUSTION SOURCE

Unit Identification No. WS-7 Year of Record 1987

Unit Description No. 1 Boiler

Date Installed 1981

Design Firing Rate (Million Btu/hr) 350

For Compressors Only, List Design Horsepower _____

Actual Fuel Combustion for the Year for Unit:

	Amount	Heat Content	Sulfur Content	Ash Content
Coal	<u>84,100</u> Ton/yr	<u>9800</u> Btu/lb	<u>0.5</u> %	<u>8</u> %
Fuel Oil	_____ Gal/yr	_____ Btu/gal	_____ %	_____ %
Nat. Gas	_____ 10 ⁶ SCF	_____ Btu/ft ³	_____ %	_____ %
Other	_____ ()	_____ ()	_____ %	_____ %

Operating Parameters:

Operated 24 hr/day, 7 days/wk, 52 wks/yr.
 Total Operating Hours This Year 8288
 Average Load This Year (% Capacity) 61
 Percent Annual Load: Winter 61 Spring 61 Summer 61 Fall 62

Stack Parameters and Control Equipment:

Stack Height	<u>180.5</u>	Feet
Stack Diameter	<u>6</u>	Feet
Stack Velocity	<u>84</u>	Feet/sec
Stack Temperature	<u>125</u>	F
Flow Rate	<u>142,800</u>	ACFM

Control Equipment Description: Primary Flakt Electrostatic Precipitator
 Secondary Flakt Spray Tower Absorber

Emission Data:

	lb/hr	TPY	Method of Determination	Date of Latest Test
Particulate	<u>8.9</u>	<u>36.9</u>	<u>method 5</u>	<u>7/83</u>
Sulfur Dioxide	<u>5.8</u>	<u>24.0</u>	<u>" 6</u>	<u>8/83</u>
Nitrogen Oxides	<u>170.2</u>	<u>705.3</u>	<u>" 7</u>	<u>4/84</u>
Carbon Monoxide	<u>17.5</u>	<u>72.5</u>	<u>Allowable rate</u>	<u>N/A</u>
NMHC	<u>0.5</u>	<u>2.07</u>	<u>Allowable rate</u>	<u>N/A</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

(NMHC is Non-Methane Hydrocarbons)

FUEL COMBUSTION SOURCE

Unit Identification No. WS-8 Year of Record 1987

Unit Description No. 2 Boiler

Date Installed 1981

Design Firing Rate (Million Btu/hr) 350

For Compressors Only, List Design Horsepower _____

Actual Fuel Combustion for the Year for Unit:

	Amount	Heat Content	Sulfur Content	Ash Content
Coal	<u>84,800</u> Ton/yr	<u>9800</u> Btu/lb	<u>0.5</u> %	<u>8</u> %
Fuel Oil	_____ Gal/yr	_____ Btu/gal	_____ %	_____ %
Nat. Gas	_____ 10 ⁶ SCF	_____ Btu/ft ³	_____ %	_____ %
Other	_____ ()	_____ ()	_____ %	_____ %

Operating Parameters:

Operated 24 hr/day, 7 days/wk, 52 wks/yr.

Total Operating Hours This Year 8363

Average Load This Year (% Capacity) 64

Percent Annual Load: Winter 65 Spring 62 Summer 63 Fall 66

Stack Parameters and Control Equipment:

Stack Height	<u>180.5</u>	Feet
Stack Diameter	<u>6</u>	Feet
Stack Velocity	<u>88</u>	Feet/sec
Stack Temperature	<u>120</u>	F
Flow Rate	<u>149,000</u>	ACFM

Control Equipment Description: Primary Flakt Electrostatic Precipitator

Secondary Flakt Spray Tower Absorber

Emission Data:

	lb/hr	TPY	Method of Determination	Date of Latest Test
Particulate	<u>9.6</u>	<u>40.1</u>	<u>Method 5</u>	<u>2/83</u>
Sulfur Dioxide	<u>17.3</u>	<u>72.3</u>	<u>" 6</u>	<u>2/83</u>
Nitrogen Oxides	<u>160.2</u>	<u>669.9</u>	<u>" 7</u>	<u>2/84</u>
Carbon Monoxide	<u>17.5</u>	<u>73.2</u>	<u>Allowable rate</u>	<u>N/A</u>
NMHC	<u>0.5</u>	<u>2.1</u>	<u>Allowable rate</u>	<u>N/A</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

(NMHC is Non-Methane Hydrocarbons)



May 18, 1984

Mr. Lee Gribovicz
Department of Environmental Quality
Air Quality Division
210 Lincoln Street
Lander, Wyoming 82520

Dear Mr. Gribovicz:

Enclosed is the compliance test report for NO_x emissions at Tenneco's No. 1 boiler stack.

Compliance testing at this stack was completed on April 30, 1984. The three tests were run at steam rates between 204,000 and 220,000 lb/hr. This is approximately 70% of design, and is representative of the steam rate required for each boiler in order to produce 1,000,000 tons per year of soda ash.

The average actual emission rate over three tests was .58 lb/MM Btu or 170.2 lb/hr, as compared with an allowable emission rate of .70 lb/MM Btu or 245 lb/hr.

This completes all compliance testing required by Tenneco's original Permit No. CT-234.

Sincerely,

TENNECO MINERALS COMPANY



M. S. Litus
Environmental Engineer

MSL:drf

cc: Mr. Randolph Wood, Administrator, AQD
Mr. Dennis Wolman, US EPA

bcc: J. M. Corcoran
R. A. Hodgson
E. W. Mortensen
T. G. Kalivas/
D. O. Phillips

SOLVAY2016_1.3_000482



March 16, 1984

Mr. Lee Gribovicz
Department of Environmental Quality
Air Quality Division
210 Lincoln Street
Lander, Wyoming 82520

Dear Mr. Gribovicz:

Enclosed is the compliance test report for NO_x emissions at Tenneco's No. 2 boiler stack.

Compliance testing at this stack was completed on February 15, 1984. All three tests were run at approximately 220,000 lb/hr steam rate. This steam rate is slightly more than 70% of design, and is representative of the steam rate required for each boiler in order to produce 1,000,000 tons per year of soda ash.

The average actual emission rate over three tests was .54 lb/MM Btu, or 160.2 lb/hr, as compared with an allowable emission rate of .70 lb/MM Btu or 245 lb/hr.

Tenneco's efforts at completing compliance testing at the boiler stacks have been delayed due to the persistent sub-zero temperatures encountered this winter. Our plans to begin testing the No. 1 boiler stack in late February were further set back as a result of unexpected operational problems: A leak developed in one of the economizer tubes. Upon inspection, it was discovered that several of the tubes had been damaged and that extensive repair work would be necessary. The repairs should be completed by early April, at which time the boiler will be started up and NO_x testing will resume. We hope to submit the test report for the No. 1 boiler stack by the end of April.

Sincerely,

TENNECO MINERALS COMPANY

M. S. Litus
Environmental Engineer

MSL:drf

cc: Mr. Randolph Wood, Administrator, AQD
Mr. Fred Longenberger, US EPA

bcc: JMC
RAH
DSL

SOLVAY2016-13-000484



P.O. Box 1167
Green River, Wyoming 82935

May 18, 1983

Mr. Lee Gribovicz
Department of Environmental Quality
Air Quality Division
210 Lincoln Street
Lander, WY 82520

Dear Mr. Gribovicz:

Compliance testing of Tenneco's calciner stack was completed on March 11, 1983. Testing consisted of three particulate, SO₂, and NO_x tests. All tests were run at maximum attainable calciner feed rates, which^x ranged from 80% to 87% of design rate.

All tests show that actual emission rates are well below the allowable limits. A comparison of the average actual emission rates with allowable emission rates is as follows:

<u>Parameters</u>	<u>Actual lb/hr</u>	<u>Allowable (DEQ) lb/hr</u>	<u>Allowable (EPA) lb/hr</u>
Particulate	15.6	35.6	34.02
SO ₂	0	85.6	85.6
NO _x	160.9	300.0	300.0

Test data and results are enclosed. Please let me know if you have any questions.

Sincerely,

TENNECO OIL COMPANY

M. S. Litus
Environmental Engineer

MSL/tas

Enclosures

cc: Mr. Randolph Wood, Administrator, AOD,
Mr. Fred Longenberger, U. S. Environmental Protection Agency

bcc: D. R. Delling
R. A. Hodgson

L. H. E. Weyher

T. G. Kalivas/D. O. Phillips

SOLVAY2016_1.3_000486

COMPLIANCE TEST RESULTS

Calcliner Stack
Point Source No. 17

Particulate Emissions:

Run No. 1 = Isokinetic	=	100.20%
Emission Rate (front of filter)	=	18.95 lb/hr
Emission Rate (total)	=	21.87 lb/hr
Grain Loading	=	.0108 gr/SCF
Calcliner Feed Rate	=	200 TPH trona
Run No. 2 = Isokinetic	=	103.02%
Emission Rate (front of filter)	=	9.93 lb/hr
Emission Rate (total)	=	13.76 lb/hr
Grain Loading	=	.0069 gr/SCF
Calcliner Feed Rate	=	186.2 TPH trona
Run No. 3 = Isokinetic	=	105.96%
Emission Rate (front of filter)	=	9.65 lb/hr
Emission Rate (total)	=	11.03 lb/hr
Grain Loading	=	.0072 gr/SCF
Calcliner Feed Rate	=	185.8 TPH trona

SO₂ Emissions:

Run No. 1 = Emission Rate	=	0 lb/hr
Calcliner Feed Rate	=	187.6 TPH trona
Run No. 2 = Emission Rate	=	0 lb/hr
Calcliner Feed Rate	=	183.7 TPH trona
Run No. 3 = Emission Rate	=	0 lb/hr
Calcliner Feed Rate	=	183.7 TPH trona

NO_x Emissions:

Run No. 1 = Emission Rate	=	152.1 lb/hr
Calcliner Feed Rate	=	186.2 TPH trona
Run No. 2 = Emission Rate	=	156.1 lb/hr
Calcliner Feed Rate	=	185.2 TPH trona
Run No. 3 = Emission Rate	=	174.5 lb/hr
Calcliner Feed Rate	=	183.7 TPH trona

per DAP 3/7/03
@ 1.4 MM Btu/hr ton ore
0.58 lb NO_x/MM Btu
0.60
0.68
X = 0.62 lb NO_x/MM Btu

1986 year end totals

soda ash produced

904,052

ore consumed

1,498,521

Coal consumed

257,924

" Calumet = 106,300

" boilers = 151,624

Soda ash loaded

per DAP 3/17/03

1.4 MMBtu

890,515

ore mined

for ore

1,505,038

Soda ash sales

884,678

Bldg Inventory start of 86 = 41,316

Bldg Inventory end of 86 = 38,533

Fly Ash

to boilers

50% Fly Ash

$$\begin{aligned} @ 8\% \text{ ash} &= .08 \times 151,624 \times .50 \\ &= 6065 \end{aligned}$$

Coal consumption Boilers = 151,624 TPY

13880 hrs operated

B-1 = 56%

B-2 = 44%

$$B-1 = 151624 \times .56 = 84909$$

$$B-2 = 151624 \times .44 = 66715$$

1987 Data:

Soda Ash Production: 1,018,446

Trona Ore Production: 1,682,509

Soda Ash Loaded 1,018,011

Alkaten Production 13,972

Alkaten Sales 14,019

Ore to Alkaten 13,972

Trona Usage (Plant) 1,683,005

Coal Consumption 5.71 MM Btu/ton (287,032 tons)

from Dean
Malone { Boilers
Calciners

168,957 TONS

118,075 tons

per D.A. 7/7/03
= 1.4 MM Btu
/ ton ore

Fly Ash =

$$\begin{aligned} @ 8\% \text{ ash} &= .08 \times 168,957 \times .50 \\ &= 6758 \end{aligned}$$

(50% fly ash)

Coal Consumption at boilers = 168,957 tons

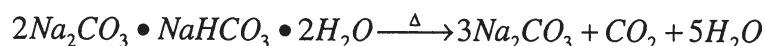
$$16651 \text{ hrs operated} - B1 = \frac{8288}{16651} = 49.8\%$$

B1 = 84,141 tons
B2 = 84,816 tons

$$B-2 = \frac{8363}{16651} = 50.2\%$$

FACILITY DESCRIPTION

The Solvay facility is an existing underground trona mine with surface processing facilities. The trona ore (sodium sesquicarbonate dihydrate [$\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$]) is processed into sodium-based products, including soda ash (sodium carbonate [Na_2CO_3]). Construction of the facility began in 1979, and it became operational in 1982. The air emission sources consist principally of calciners, dryers, boilers, and material handling processes. The facility is presently permitted under Wyoming Operating Permit No. 30-126 and has the potential to emit (PTE) of 405 tpy of particulate matter (PM_{10}); 619 tpy of sulfur dioxide (SO_2); 2,440 tpy of nitrogen oxides (NO_x); 2,464 tpy of volatile organic compounds (VOC); and 7,431 tpy of carbon monoxide (CO). There are four gas-fired calciners, two gas-fired dryers, two coal-fired boilers, and other smaller gas-fired combustion units. This application addresses a proposed change in the heat-generating furnaces associated with two of the calciners. Calciners are used to convert the trona ore to crude soda ash by driving off the carbon dioxide (CO_2) and water (H_2O). The equation is as follows:



Solvay is proposing to convert the furnaces associated with Calciners A and B (Source #17) from natural gas-firing to coal-firing. Coal and trona particulate matter generated in the furnace and calciner will be controlled by an electrostatic precipitator (ESP) before being vented through a common stack. Stack parameters are provided in Table 2.1. There will be a calciner coal bunker for coal storage and handling with an associated baghouse to control particulate emissions. This source was deleted in the 1995 conversion from coal to gas-firing (MD-229), but will be refurbished and repermited for this project. The stack parameters for this new source (Source #100) are provided in Table 2.2. From Table 2.1 it is apparent that with the shift to coal-firing, Source #17 will experience a twenty percent reduction in heat rate, but an increase in airflow, resulting in a substantial increase in airflow per unit of heat. The other stack parameters will remain the same. The potential to emit (PTE) and 2000/2001 actual emissions are shown in Table 2.3. The plant layout with the various buildings and all the facility emission points is shown on Figure 2.1, with Sources #17 and #100 specified.

With an increase in coal consumption related to Source #17, there could be an increase in the number of operating hours of existing coal-associated baghouses, resulting in an increase in actual emissions from Sources #10 (Coal Crusher) and #11 (Coal Transfer). These two sources had average actual PM_{10} emissions of 0.18 and 0.15 tpy for 2000 and 2001. Actual emissions will remain at or below the presently permitted PTEs of 1.14 and 0.92 tpy, respectively. Since these emission sources are not being modified, their actual emission increases are not addressed further.

Table 2.1: Modified Source #17 Physical Stack Parameters

Description	Present	Proposed
Height	180.5 ft	Unchanged
Heat Rate	500 MMBtu/hr	400 MMBtu/hr
Exit Diameter	12 ft	Unchanged
Exhaust Velocity	44 ft/sec	96 ft/sec
Exhaust Temperature	375°F	400°F
Flow Rate	312,000 ACFM	650,000 ACFM
Location	603,686 m (East)	Unchanged
	4,594,808 m (North)	Unchanged

Table 2.2: New Source #100 Physical Stack Parameters

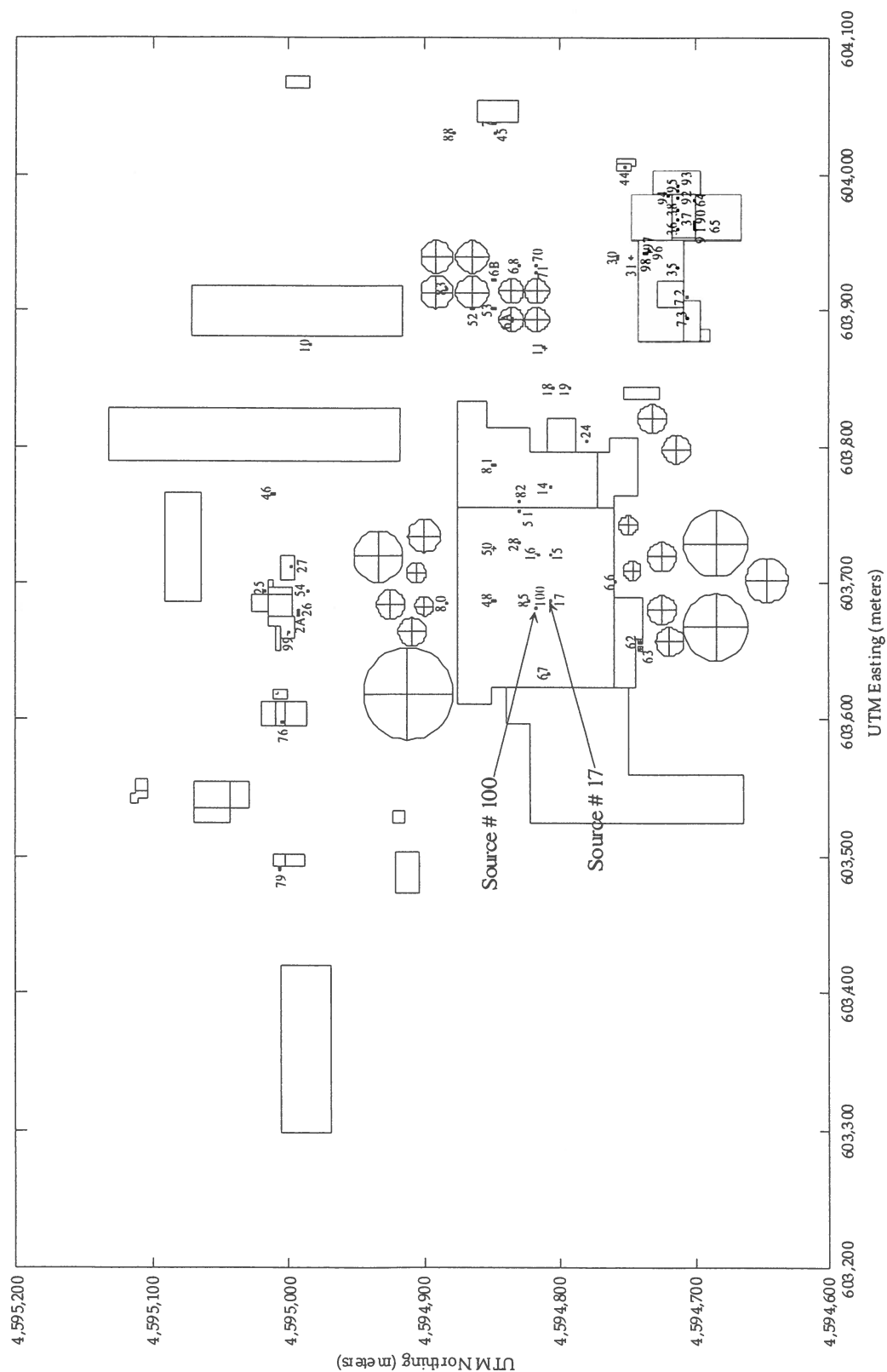
Description	Proposed
Height	126 ft
Exit Diameter	1 ft
Exhaust Velocity	64 ft/sec
Exhaust Temperature	Ambient (68°F)
Flow Rate	3,000 ACFM
Location	603,681 m (East)
	4,594,817 m (North)

Table 2.3: Sources #17 and #100 Emission Rates in Tons per Year (tpy)

Column #1	Column #2	Column #3	Column #4	Column #5	Column #6	Column #7	Column #8
Pollutant	Source #	Present Actual Emissions*	Present Potential to Emit	Proposed Potential to Emit	PSD Review Threshold	Increase From Actual to Proposed PTE	PSD Review Triggered?
NO _x	17	49	131	788	40	739	yes
CO	17	1,077	6,675	5,533	100	4,456	yes
PM ₁₀	17	32	98	180	15	148	yes
	100	0	0	1	15	1	
VOC (as ozone precursor)	17	1,199	3,399	2,714	40	1,515	yes

* Average of years 2000 and 2001.

Figure 2.1: Solvay Facility Plant Layout and Emission Points



The 2000 and 2001 averaged actual emission rates and permitted potential to emit (PTE) for Source #17 are provided in Columns 3 and 4 of Table 2.3. The proposed PTEs under coal-firing of Sources #17 and #100 are listed in Column 5. For purposes of determining the triggering of "Major Modification" (Wyoming Air Regulations, Chapter 6, Section 4(a)(xii)), the "net emissions increase" is to be calculated. The net emissions increase is the difference between the proposed PTE and the present actual emissions. The review threshold amounts are listed in Column 6. The net emissions increase is provided in Column 7. From these increases it is apparent that NO_x, CO, PM₁₀, and VOC emissions are to be reviewed by the Major Modification review procedures.

Comparing present PTE (Column 4) with proposed PTE (Column 5), the increased NO_x emissions are due to an increase in the emission factor (mass of NO_x per unit of heat) of the coal burner. Although there will be sulfur in the coal, the trona ore will effectively absorb all of it during the calcination process. This has been previously demonstrated by stack tests when Source #17 was originally fired on coal. (Note that trona and soda ash are commonly used as SO₂ scrubbing agents.) There will be a minor increase in the coal burner's CO emission factor, offset by the decrease in trona feed rate and the CO emissions inherent in the trona calcination process. This results in the proposed PTE being less than the present PTE. There will be no change in the VOC emission factor, which is almost entirely a function of the trona feed rate (mass of VOC per unit of trona feed), but there will be a decrease in the VOC emissions because of a decrease in the trona feed rate, resulting in the proposed PTE being less than the present PTE. There will be no increase in the PM₁₀ emission factor (mass of PM₁₀ per unit of airflow through the electrostatic precipitator). However, since there will be an increase in airflow, there will be an increase in the mass of potential PM₁₀ emissions.

SECTION 3

AREA DESIGNATION AND APPLICABLE REQUIREMENTS

The permitting process is described in the Wyoming Air Quality Standards and Regulations (WAQS&R) Chapter 6. Since southwest Wyoming is designated as an attainment area for all Wyoming Ambient Air Quality Standards (WAAQS), this permit modification need only address attainment regulations. In addition to the permitting requirements, New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements are also applicable. The applicable requirements are:

Chapter 5, Section 2: There is no applicable NSPS for Source #17. Subpart UUU addresses "Calciners and Dryers in the Mineral Industries," but soda ash is not included within the definition of such an industry (Subpart 60.731). Subpart Y – Standards of Performance for Coal Preparation Plants may be applicable to Source #100, which limits opacity to twenty percent (20%).

Chapter 5, Section 3 (NESHAPs): Neither Source #17 nor #100 is in a listed source category. Therefore, this section is not applicable.

Chapter 6, Section 2(a)(i): Solvay proposes to modify an existing facility, which may cause an increase in air contaminants. Thus, Solvay must obtain a construction permit.

Chapter 6, Section 2(b)(i): The application is to include plans, specifications, and the manner in which the sources are to be operated and controlled.

Baseline ambient monitoring may be required at the discretion of the Administrator. This proposed modification may result in a potential increase in NO_x and PM₁₀ emissions. There will also be a present actual to future potential increase for CO and VOCs. Solvay previously monitored for NO_x and TSP, and is currently monitoring for PM₁₀. NO_x monitoring was discontinued in 1988 due to the low concentrations (average for 1987 was 5 µg/m³). The on-site PM₁₀ monitor has shown no exceedance of the Wyoming PM₁₀ 24-hour or annual standards. Additional regional monitoring has been conducted for ozone through the Green River Basin Visibility Study and for CO at Riley Ridge. Solvay believes sufficient monitoring has been conducted to define a representative baseline for this application.

Chapter 6, Section 2(c)(ii): The application must demonstrate compliance with the WAAQS, as shown in Section 5 of this application.

Chapter 6, Section 2(c)(iii): The application must demonstrate compliance with PSD increments, as shown in Section 5 of this application.

Chapter 6, Section 2(c)(v): The sources must utilize the Best Available Control Technology (BACT). A BACT analysis is found in Section 4 of this application.

Chapter 6, Section 2(c)(vi): The facility must have provisions for measuring the emissions of significant air contaminants as determined by the Administrator. These are already in place for the present configuration of Source #17, as described in the current Permit OP 30 - 126. The significant increase in NO_x will trigger the 40 CFR Part 64 Compliance Assurance Monitoring (CAM) requirements. The proposed methods to comply with CAM are described in Section 7 of this application.

Solvay is subject to Chapter 6, Section 3 (Major Source Operating Permits), and will submit a separate application for that purpose within 12 months after the Source #17 conversion, as required

To determine if the "Major Modification" permit review requirements are triggered per Chapter 6, Section 4(a)(x), Section 4(a) (xii) requires a calculation of the "net emissions increase." That is the difference between the present actual emissions and the proposed PTE. The net emissions increase is provided in Column 7 of Table 2.3, and illustrates that NO_x, CO, PM₁₀, and VOC emissions are to be reviewed by the Chapter 6, Section 4, Major Modification review procedures.

Chapter 6, Section 5: This regulation is not applicable because there are no Maximum Achievable Control Technology (MACT) standards for these sources.

Chapter 6, Section 6(h)(112 [g] MACT for Constructed and Reconstructed Major Sources): Source #17 is not being constructed or reconstructed per the definition of "applicability" in Section 6(h)(i) and because the new burner in and of itself will not emit 10 tpy of any hazardous air pollutant (HAP) or 25 tpy of any combination of HAPs per the definition of "reconstruction" in Section 6(f)(xii).

Chapter 6, Section 6(h)(iv) (112[j] case-by-case MACT): Source #17 is not a listed source within the October 16, 2002 updated list of proposed MACT Source Categories.

SECTION 4

PROPOSED CONTROLS - BACT

The potential emissions from coal combustion from Source #17 are presented in Table 2.3, Column 5, and the calculation is presented in Appendix A. There will be significant increases in the NO_x, CO, PM₁₀, and VOC emissions, which trigger a Best Available Control Technology (BACT) review for these four pollutants. The following BACT analysis considers control technologies outside the trona/soda ash industry because the industry is small and unique and there are insufficient recent process designs on which to base "current control practices." There are four mines with processing facilities operating in close proximity to each other in southwest Wyoming. There are two other facilities in the U.S. that produce soda ash, but they have a feedstock other than trona.

Solvay proposes to modify the furnaces that provide hot air to Calciners A and B (Source #17). The calciners will not be modified, so this BACT analysis only addresses the furnaces with their associated revised emissions. The industrial furnaces will be fueled by coal at a rate of 200 MMBtu/hr. These furnaces are different from boilers with regard to the combustion kinetics and NO_x formation. A boiler contains heater tubes that extract heat as the combustion air flows down the boiler. By removing the heat quickly, the temperature is reduced, thereby suppressing thermal NO_x production. These furnaces are also unlike those associated with cement, lime, kaolin kilns, or diatomaceous earth calciners. In those applications, combustion takes place within the calciner. The purpose of the industrial furnaces associated with the trona calciners is to supply hot air for calcination of the trona ore to soda ash. This is a unique process.

The BACT process is described in the "Puzzle Book" (New Source Review Workshop Manual, Draft, October 1990, U. S. EPA, Chapter B). The process consists of five distinct steps for the purpose of determining BACT. These steps are:

- Identify all available control technologies.
- Eliminate technically infeasible options.
- Rank remaining control technologies by control effectiveness.
- Evaluate most effective controls and document costs.
- Select BACT.

4.1 BACT Review - NO_x Emissions

The BACT review process described above is applied to the NO_x emission controls for the Solvay industrial furnaces in this subsection.

4.1.1 Identify all Available NO_x Combustion Control Technologies

AP-42 Section 8.12 addresses the Sodium Carbonate industry, but in that section there is no discussion of combustion emissions and controls. That section refers to Chapter 11, Mineral Products Industry, for more specific emissions information. In fact, AP-42, Chapter 1, Section 1, "Bituminous and Subbituminous Coal Combustion," comes closest of all AP-42 sections to addressing the NO_x control methods available to Solvay for these furnaces; however, this section is directed almost entirely to boilers. The list of NO_x control options from this section is given below. Section 11.17, Lime Manufacturing; Section 11.3, Brick and Related Clay Products; and Section 11.6, Portland Cement Manufacturing, also discuss NO_x controls and add the "preheater" as an option to those listed in Chapter 1, Section 1. The range of the NO_x control options derived from these AP-42 sections is as follows:

- Operational Modifications (rearrangement of air and fuel for good engineering design [GED])
- Over-Fire Air (OFA)
- Low-NO_x Burners (LNB)
- Reburn
- Selective Non-Catalytic Reduction (SNCR)
- Selective Catalytic Reduction (SCR)
- Preheaters

Solvay's engineers add the following two possible control technologies:

- Flue Gas Recirculation (FGR)
- Water Injection (WI)

A search of the RACT BACT LAER Clearinghouse (RBLC) for other possible NO_x control technologies applied to coal-fueled devices other than boilers (e.g., furnaces, incinerators, kilns, dryers) yields the information in Table 4.1.

Table 4.1: Installed NO_x Control Technologies Listed in the RBLC for Coal-Fueled Devices Other Than Boilers

Control Technology	Number of Cases in the Clearinghouse
No control	15
Careful combustion control	18
Low-NO _x combustors	9
Urea spray into preheater combustion zone – SNCR	2
Conversion to add a pre-calciner (preheater)	3
Steam injection, alkaline stream in venturi scrubber	1
Kiln afterburner	1
Wet scrubbers	2
Baghouse	2

The California Air Resources Board Control Technology database contributed two additional sources. Both determinations were for cement plants, and both employed pre-calciners and good combustion practices.

From these tables, wet scrubbers, baghouses, and steam injection into the venturi scrubber are discounted, since they are actually controls for particulates. It is concluded that there are no additional NO_x technologies to add to the AP-42 and Solvay Engineers list.

4.1.2 Eliminate Technologically Infeasible Technologies

There are two fundamentally different types of coal-fueled furnaces that could satisfy the Solvay calciner needs, pulverized coal (PC) and stoker coal (SC). Both are limited in size by the volume available in front of the calciner and limited in slagging characteristics to a buildup rate that will not substantially disrupt operations. The location restriction is forced by the need to be near the calciner inlet to maintain a high input air temperature, and to be near the flue gas for NO_x control purposes (as explained later in this section).

Regardless of the furnace type, SCR is infeasible because the temperatures of the exhaust gases at the exit of the calciner are 300°F to 400°F, which is well below the 700°F minimum temperature needed for the SCR reaction.

A furnace, unlike a boiler, has no heat extraction as gases pass down the furnace. Because of that, low NO_x burners (LNB) for furnaces are ruled out as a technically feasible control technology, as described in AP-42 (page 1.1-9) in the following statement:

LNBs are applicable to tangential and wall-fired boilers of various sizes but are not applicable to other boiler types such as cyclone furnaces or stokers.

Preheaters are devices unique to cement and lime kilns. They are technologically infeasible as there is insufficient waste heat in the Solvay calciner circuit to provide pre-heating to the feedstock.

Reburn is a control technology that requires injection of natural gas downstream of the coal combustion and is applicable only in very specific boiler configurations, different from the Solvay furnaces. It is technologically infeasible for Solvay's application.

The remaining NO_x control possibilities are GED, OFA, SNCR, FGR, and WI as possibly being technologically feasible.

Solvay retained an expert coal combustion specialty firm (Reaction Engineering, Salt Lake City) to assist in the design and selection of the furnace technologies. Reaction Engineering requested bids for the two alternative furnace types, PC and SC, with emphasis on the need for low-NO_x emissions. The results are as follows:

PC Furnace Design

The combustion engineering consultant performed a survey of the market for current designs that could meet heat input requirements, space limitation criteria, and provide low-NO_x emissions. The results from the search for the PC-fired designs are attached in Appendix B. The conclusion is that most manufacturers do not have, nor are they interested in developing a furnace for Solvay's needs that would have NO_x emissions any lower than the 0.7 lb/MMBtu of the original Solvay furnace.

One manufacturer offered a theoretical design (listed under Black & Veatch/Damper Design) that could meet 0.35 lb NO_x/MMBtu under the special requirements of an additional gas-fired inlet air duct heater (10 MMBtu/hr) and micronized coal injection, both of which are relatively untested, and not tested for Solvay's specific requirements. Moreover, this special furnace would require the use of natural gas with the coal for proper operation. This special furnace would be considered, at best, as available through technology transfer. However, it has not been shown in any full-scale operation to provide the required service to the calciner. In other words, there is no demonstration that it can actually do the job reliably (operation without system breakdowns and unacceptable slag buildup, shown to occur in previous PC furnace testing for Solvay) for which it is being considered. Thus, in line with the EPA guidance Puzzle Book, Chapter B, IV, A, 1, "technologies which have not yet been applied to full-scale operations need not be considered available; an applicant should be able to purchase or construct a process that has already been demonstrated in practice." Solvay considers this special design to not be a "commercially available" process unit.

SC Furnace Design

Detroit Stoker Company provided a bid for an SC furnace with low-NO_x emissions. In their design they experimented with four of the remaining process modifications for NO_x control not yet eliminated as technologically feasible control technologies, incorporating GED and OFA in all designs. The results of the combustion modeling with these control options are shown in Table 4.2. Prior to converting the coal-fired calciners to gas in 1995, the NO_x emission rate was 0.7 lb/MMBtu with a stoker-coal system. The original OFA configuration has been revised to increase energy efficiency, and results in a modeled emission rate of 0.79 lb NO_x/MMBtu. Water injection into the furnace could reduce that emission rate to 0.5 lb NO_x/MMBtu. By recirculating 30% of the flue gases, the emission rate could be reduced to 0.42 lb NO_x/MMBtu.

These emission rates were estimated by a Computational Fluid Dynamic (CFD) model and have not been demonstrated in a commercial furnace. However, utilizing GED, OFA, FGR, and retaining the option to also use WI if necessary, Detroit Stoker Company has guaranteed an emission rate of 0.45 lb NO_x/MMBtu. As is common in reducing NO_x emissions, there is a trade-off with increased CO emissions. The CO and NO_x emissions are detailed in the table below with the revised OFA and addition of WI and FGR.

Table 4.2: NO_x Emissions for Various Combinations of Controls Built Into the Furnace Design

	Original OFA Config. (1980)	Revised OFA Config.	WI + Revised OFA Config.	FGR + Revised OFA Config.
Exit CO (ppm)	34	25	22	522
Exit NO _x (lb/MMBtu)	0.70	0.79	0.50	0.42
Exit NO _x (ppm)	278	308	194	161

SNCR is an add-on control technology that, to the knowledge of Detroit Stoker (letter is included in Appendix B), has not been applied to similar applications of SC furnaces. It has not been installed in a furnace associated with a trona calciner, and there is no prior application to furnaces listed in the RBLC. To determine if SNCR could be a feasible technology would require research and testing. The method for injecting ammonia would need to be determined as well as the adequacy of the mixing and residence time downstream of the combustion zone for reducing NO_x. Therefore, Solvay considers SNCR to not be commercially available for its furnace application.

Although the Solvay furnaces are unlike other coal-fueled source categories, a statistical summary of the NO_x emission factors for all facilities other than boilers from the RACT BACT LAER Clearinghouse (RBLC, 1993 - 2002) is provided in Table 4.3 for comparison. To generate Table 4.3, an assumption was made for some of the lime and cement kilns that an average thermal efficiency of 5.5 MMBtu heat input was required per ton of product in order to convert all emissions to the units of mass NO_x per MMBtu heat input. By comparing the proposed

Solvay furnace NO_x emission rate of 0.45 lb/MMBtu to the rates found in Table 4.3, it is found to be below the average for all four categories and below or near the minimums.

Table 4.3: Pounds of NO_x per MMBtu From Coal-Fueled Devices Other Than Boilers

Process	Count	Average	Min.	Max.	Range
Cement	10	1.26	0.43	3.40	2.97
Lime	6	0.53	0.37	0.64	0.27
Coal dryer	5	0.55	0.43	0.80	0.37
Refractory	2	6.55	6.18	6.91	0.73

4.1.3 Selection of BACT for NO_x

Solvay asserts that the available and feasible technology with the lowest NO_x emission rate for the calciner furnaces is the Detroit Stoker design at 0.45 lb/MMBtu. Since Solvay is committing to the installation of the lowest-emitting technology, it represents BACT for NO_x emissions, and there is no need to discuss costs.

4.2 BACT Review - PM Emissions

Source #17 presently has electrostatic precipitators (ESP) installed as the particulate control. With the high quantity of airflow from trona calciners, ESPs are considered BACT.

Particulate emissions associated with Source #100 will be controlled with a baghouse to 0.01 gr/dscf. This is widely accepted as BACT for a material-handling source of this type.

4.3 BACT Review - VOC and CO Emissions

A BACT analysis was prepared for VOC and CO emissions in the CT - 1347 (February 6, 1998) permit application. The cost data provided in that analysis is still current. Since the air flow rates will be increased per unit of throughput, these costs will increase for the scenario of stoker coal combustion. Thus, that analysis is sufficient for the VOC BACT analysis. There will be no VOC control, and the CO control will consist of good combustion control with the maintenance procedures described in Appendix B of OP 30 - 126.

SECTION 5

ENVIRONMENTAL EVALUATION - CLASS II AREAS

The proposed furnace conversion is associated with a significant increase in NO_x, CO, PM₁₀, and VOC emissions. As required by the Wyoming permitting rules, the impacts of these four pollutants must be estimated for the areas surrounding the facility, which are Class II areas. The first three pollutant impacts are estimated using the Industrial Source Complex Short Term (ISCST3) Dispersion Model and five years (1987 to 1991) of Rock Springs meteorological data. The ozone (O₃) impacts, expressed in terms of VOC and NO_x emissions, are estimated using Scheffe's screening tables. The methodology for these analyses is based on the modeling protocol (dated December 2002) and on the subsequent response to the Wyoming DEQ questions (dated February 3, 2003). The Wyoming DEQ requested a full PM₁₀ increment consumption analysis with previous permit applications; therefore, although not required, the full analysis was again conducted. A screening risk assessment addressing the impacts of the Hazardous Air Pollutants (HAPs) from coal-firing is also included and is based on the above long-term ISCST3 emission-to-impact ratios. Each of these analyses is discussed briefly in the following sections.

5.1 Dispersion Modeling for NO_x, PM₁₀, and CO

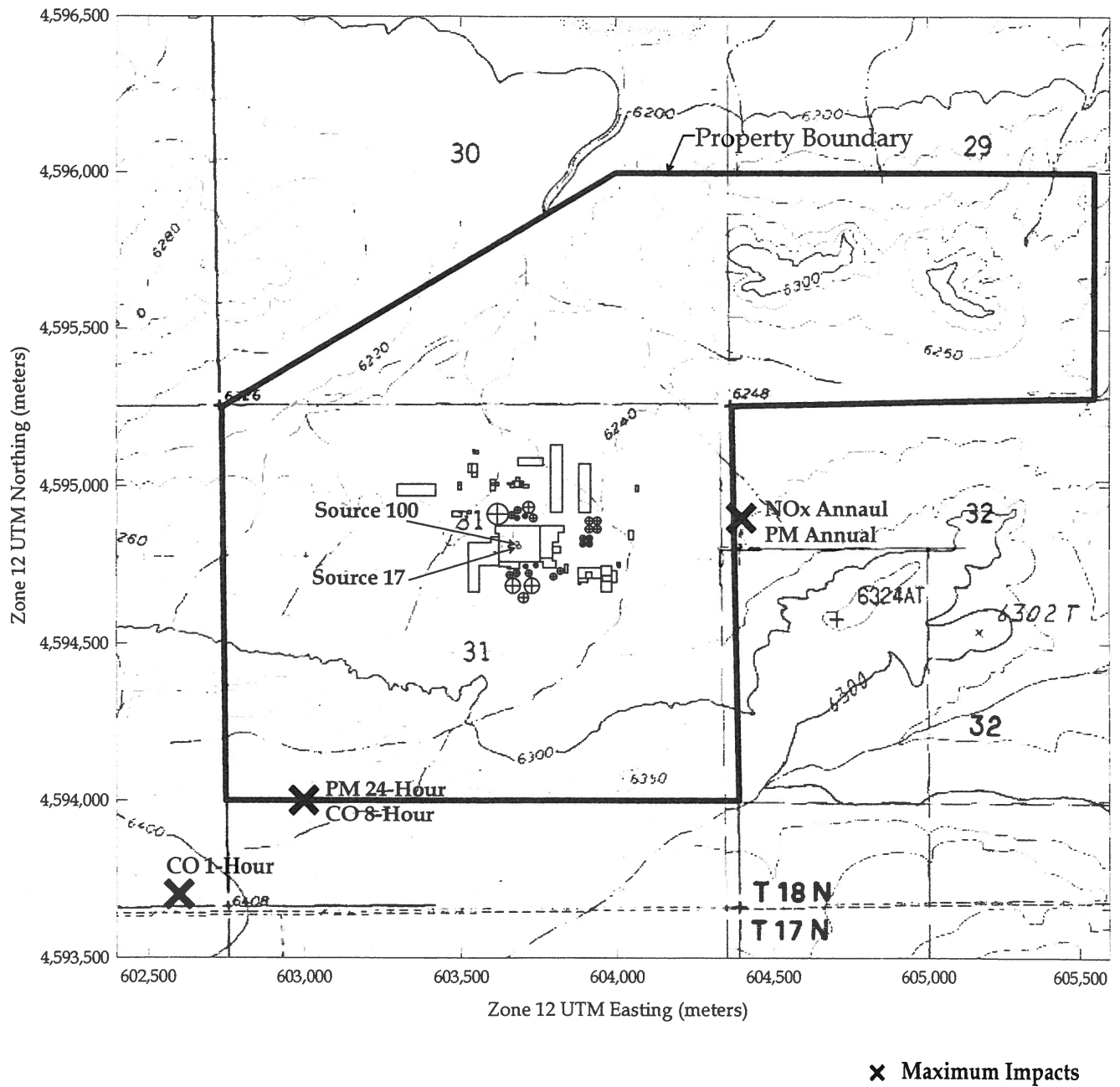
The preliminary step in the impact analysis is to determine for each pollutant whether the impacts from the net emission increases from the project (Table 2.3, Column 7) are less than the applicable Significant Impact Levels (SILs). If the impacts are less than the SILs, then no actual impact analysis is required. However, if the impacts are significant, then a full analysis is needed.

Results of the preliminary analysis are summarized in Table 5.1. The source locations, property boundary, and locations of the maximum impacts (from Table 5.1) are presented in Figure 5.1. This figure shows that all of the maximum impacts occur on or near the property boundary line, and Table 5.1 shows that impacts of the three pollutants are below their respective SILs for all averaging periods. Thus, no further Class II impact analyses are required for these pollutants.

Table 5.1: Estimated Maximum Impacts Compared With SILs

Pollutant	Averaging Period	Maximum	Location		Year	SIL (µg/m ³)
		Impact (µg/m ³)	Easting (m)	Northing (m)		
NO _x	Annual	0.6	604,400	4,594,900	1988	1.0
PM ₁₀	Annual	0.2	604,400	4,594,900	1988	1.0
	24-Hour	2.8	603,000	4,594,000	1991	5.0
CO	8-Hour	161.0	603,000	4,594,000	1991	500.0
	1-Hour	363.7	602,600	4,593,700	1989	2,000.0

Figure 5.1: Maximum Impacts from Proposed Emission Increases from Source # 17 and # 100



The ISCST3 and BPIP model input and output files, meteorological data files, DEM files, and other related documentation are provided on the attached compact disk.

5.2 O₃ Evaluation

There is no SIL for O₃, so the O₃ impacts are estimated and compared with the applicable WAAQS. The O₃ impact analysis uses Scheffe's screening tables (VOC/NO_x Point Source Screening Tables, 1988). The procedure and calculations for O₃ estimation and applicable rural screening table are presented in Appendix C on Sheets C.1 and C.2. The maximum predicted O₃ concentration from Scheffe's screening table, the O₃ background concentration, and the applicable Wyoming O₃ standard are shown in Table 5.2.

Table 5.2: Estimated O₃ Concentration Compared With WAAQS

Averaging Period	Estimated Concentration (µg/m ³)	Background Concentration (µg/m ³)	Maximum Predicted Concentration (µg/m ³)	WAAQS (µg/m ³)
1-hour	66.1	161.0	227.1	235

Table 5.2 shows that the maximum predicted O₃ impact from Solvay's VOC emissions is expected to be below the O₃ WAAQS. The Background Concentration is from the Green River Basin Visibility Study (GRBVS).

5.3 Full PM₁₀ PSD Increment Consumption Analysis

Although not required by the Wyoming DEQ, Solvay also conducted a PM₁₀ increment consumption analysis to demonstrate compliance with the PM₁₀ Class II PSD increment standards. The methods were the same, except for the modified PM₁₀ emissions, as a previously conducted analysis (*Solvay Minerals Inc., Particulate Matter Impact Analysis Trona Products Expansion, April 2002*). This analysis also includes PM₁₀ increment-consuming emissions from the two nearby facilities (FMC – Westvaco and General Chemical) as recommended by the Wyoming DEQ for the previous analysis.

The Solvay facility-wide and the nearby increment-consuming sources, their PM₁₀ emission rates, and other modeling parameters are listed in Table 5.3. Again, five years (1987 to 1991) of Rock Springs meteorological data were used. The modeling methodology and the assumptions made are the same as in the previous analysis. Further details about the assumptions, the applied methodologies, and data sets used, are provided in the previous report.

The digital modeling files and a copy of the previous analysis report are provided on the attached compact disk.

Table 5.3: Modeled Stack Parameters

Emission Point ID	Base			PM ₁₀ Emission Rate (lb/hr)	Emission Rate (g/s)	Stack Height (ft)	Stack Height (m)	Exit Temperature (°K)	Exit Velocity (m/s)	Exit Diameter (m)
	UTM X (m)	UTM Y (m)	Elevation (m)							
Existing Solvay Minerals Emissions Points										
2A	603677	4594992	1900	1.59	0.20	23	7.01	293	15.85	1.06
6A	603893	4594835	1903	0.32	0.04	133	40.54	309	24.99	0.64
6B	603922	4594848	1903	0.48	0.06	15	4.72	297	10.06	0.67
7	604037	4594848	1906	1.19	0.15	82	24.99	293	19.51	0.75
10	603874	4594983	1900	0.24	0.03	13	4.05	293	5.49	0.60
11	603872	4594811	1901	0.24	0.03	35	10.76	293	6.40	0.55
14	603770	4594807	1902	0.40	0.05	125	38.10	293	17.37	0.43
15	603721	4594807	1902	4.36	0.55	180	54.86	347	14.94	1.83
16	603721	4594816	1902	0.87	0.11	126	38.40	369	12.80	1.07
18	603842	4594804	1902	5.00	0.63	180	54.86	325	17.68	2.21
19	603842	4594792	1902	5.00	0.63	180	54.86	322	18.29	2.21
24	603804	4594780	1902	0.32	0.04	25	7.62	302	12.50	0.30
25	603694	4595017	1900	1.03	0.13	76	23.16	293	14.63	0.73
26	603679	4594992	1900	0.56	0.07	67	20.42	311	17.68	0.73
27	603712	4594998	1900	0.48	0.06	60	18.29	293	18.90	0.48
28	603729	4594829	1902	2.93	0.37	140	42.67	347	12.19	1.22
30	603939	4594757	1902	0.24	0.03	88	26.82	293	17.98	0.20
31	603939	4594747	1902	0.24	0.03	88	26.82	293	17.98	0.20
35	603931	4594712	1905	1.43	0.18	103	31.39	327	14.63	0.70
36	603960	4594712	1905	0.08	0.01	60	18.29	338	25.88	0.15

Table 5.3: Modeled Stack Parameters (continued)

Emission Point ID	UTM X (m)	UTM Y (m)	Base Elevation (m)	PM ₁₀ (lb/hr)	Emission Rate (g/s)	Stack Height (ft)	Stack Height (m)	Exit Temperature (°K)	Exit Velocity (m/s)	Exit Diameter (m)
37	603967	4594712	1905	0.08	0.01	60	18.29	338	25.88	0.15
38	603974	4594712	1905	0.08	0.01	60	18.29	338	25.88	0.15
44	604005	4594752	1905	0.16	0.02	63	19.20	293	17.07	0.30
45	604030	4594847	1906	0.24	0.03	18	5.43	293	8.84	0.27
46	603765	4595011	1900	0.71	0.09	13	3.81	293	14.02	0.67
48	603687	4594848	1902	9.28	1.17	180	54.86	450	9.75	3.20
50	603725	4594848	1902	0.71	0.09	180	54.86	366	8.23	1.37
51	603752	4594829	1902	2.38	0.30	180	54.86	422	10.06	2.44
52	603901	4594864	1903	0.48	0.06	141	42.98	293	15.24	0.46
53	603901	4594848	1903	0.48	0.06	30	9.14	293	10.97	0.85
54	603694	4594986	1900	0.16	0.02	64	19.57	293	24.08	0.18
62	603657	4594740	1900	0.16	0.02	91	27.74	293	33.53	0.15
63	603652	4594740	1900	0.16	0.02	58	17.68	293	35.66	0.15
64	603981	4594700	1905	0.08	0.01	29	8.84	293	29.26	0.15
65	603962	4594700	1905	0.08	0.01	8	2.44	293	11.58	0.23
66	603701	4594758	1902	0.56	0.07	20	6.10	293	22.86	0.30
67	603634	4594808	1902	0.48	0.06	125	38.10	311	10.06	0.46
68	603933	4594829	1905	0.40	0.05	82	24.99	293	23.47	0.37
70	603933	4594817	1905	0.24	0.03	82	24.99	293	14.94	0.40
71	603928	4594817	1905	0.24	0.03	82	24.99	293	14.94	0.40
72	603910	4594706	1905	0.08	0.01	61	18.49	366	16.15	0.20

Table 5.3: Modeled Stack Parameters (continued)

Emission Point ID	UTM X (m)	UTM Y (m)	Base Elevation (m)	PM ₁₀ (lb/hr)	Emission Rate (g/s)	Stack Height (ft)	Stack Height (m)	Exit Temperature (°K)	Exit Velocity (m/s)	Exit Diameter (m)
73	603894	4594705	1905	0.87	0.11	95	28.96	305	17.07	0.61
76	603598	4595004	1900	2.46	0.31	110	33.53	293	17.22	1.12
79	603491	4595006	1900	0.87	0.11	68	20.73	293	18.26	0.63
80	603685	4594882	1902	12.21	1.54	180	54.86	425	15.49	3.20
81	603786	4594848	1902	0.48	0.06	120	36.58	394	23.29	0.51
82	603760	4594829	1902	3.41	0.43	180	54.86	421	13.15	2.44
83	603916	4594883	1903	0.40	0.05	130	39.62	366	17.47	0.51
85	603687	4594822	1902	0.48	0.06	140	42.67	436	15.24	0.91
88	604030	4594877	1906	0.24	0.03	11	3.35	293	19.51	0.30
90	603965	4594700	1905	0.08	0.01	23	7.01	293	19.20	0.15
91	603960	4594700	1905	0.08	0.01	24	7.32	293	19.20	0.15
92	603983	4594712	1905	0.32	0.04	64	19.51	293	25.91	0.32
93	603992	4594712	1905	0.16	0.02	70	21.34	293	16.15	0.30
94	603984	4594719	1905	0.32	0.04	90	27.43	293	25.91	0.32
95	603988	4594712	1905	0.08	0.01	90	27.43	293	25.91	0.15
96	603943	4594733	1905	0.16	0.02	82	25.00	293	21.94	0.25
97	603942	4594735	1905	0.10	0.01	82	25.00	293	21.94	0.20
98	603942	4594737	1905	0.40	0.05	82	25.00	293	17.07	0.46
99	603663	4595000	1900	3.24	0.41	125	38.10	293	15.24	1.37
Modified Source #17 and New Source #100										
17	603687	4594807	1902	41.1	5.18	180	54.86	477.6	29.15	3.66
100	603681	4594817	1902	0.2	0.02	126	38.4	293	19.4	0.3

Table 5.3: Modeled Stack Parameters (continued)

Emission Point ID	UTM X (m)	UTM Y (m)	Base Elevation (m)	PM ₁₀ (lb/hr)	Emission Rate (g/s)	Stack Height (ft)	Stack Height (m)	Exit Temperature (°K)	Exit Velocity (m/s)	Exit Diameter (m)
Nearby Increment-Consuming Sources from FMC-Westvaco										
BC1	599153	4608435	1896	3.01	0.38	93	28.35	350	18.63	0.76
BC2	599153	4608484	1896	1.67	0.21	91	27.74	313	10.35	0.76
MONO11	599323	4607941	1896	3.01	0.38	25	7.62	291	20.70	0.76
MONO12	599331	4608374	1896	1.74	0.22	60	18.29	294	17.25	0.91
MW3	599058	4608059	1896	0.24	0.03	130	39.62	339	18.38	1.98
RA29	598812	4608511	1896	0.32	0.04	80	24.38	355	29.51	1.22
Nearby Increment-Consuming Sources from General Chemical										
FD617	603742	4605237	1902	0.24	0.03	4	1.22	286	26.73	0.20
GR3Q	603476	4605127	1902	1.51	0.19	118	35.96	341	13.44	0.91

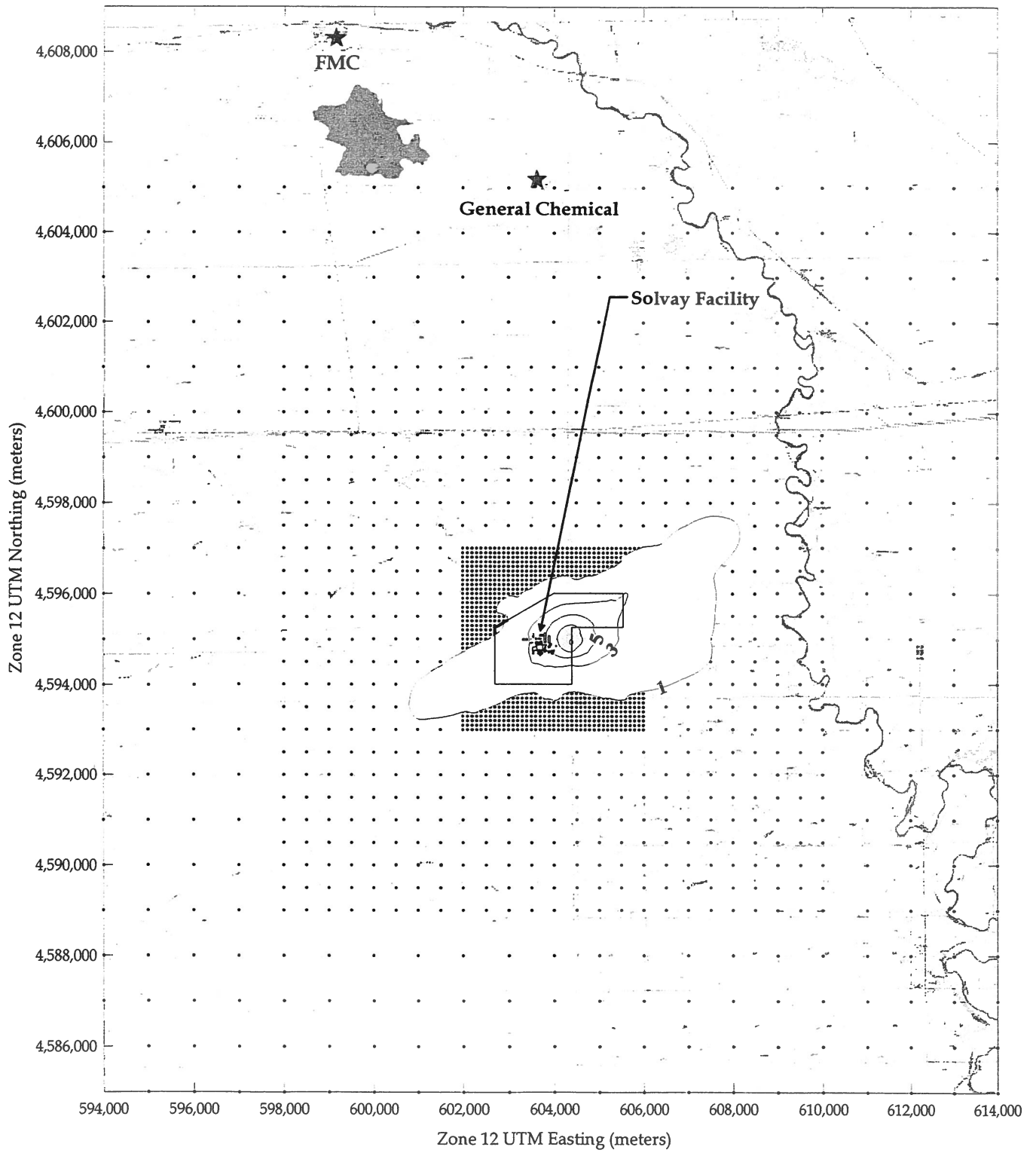
Table 5.4 shows the modeled maximum annual and the 24-hour highest second-highest (H2H) (on an annual basis from the five years of analysis) PM₁₀ concentrations as a result of Solvay and the nearby sources' increment-consuming emissions. The maximum impacts occur on the property line directly to the east of the plant. Both the maximum annual (9.3 µg/m³) and H2H 24-hour (29.1 µg/m³) concentrations are less than the applicable Class II PSD increments.

Table 5.4: Maximum Predicted PM₁₀ Impacts Compared With PSD Increments

Averaging Time	Maximum Predicted Impacts (µg/m ³)	Date	Receptor Location		Class II PSD Increment (µg/m ³)
			Easting (m)	Northing (m)	
24-hour H2H	29.1	12/26/87	604,400	4,594,850	30
Maximum annual	9.3	1988	604,400	4,594,950	17

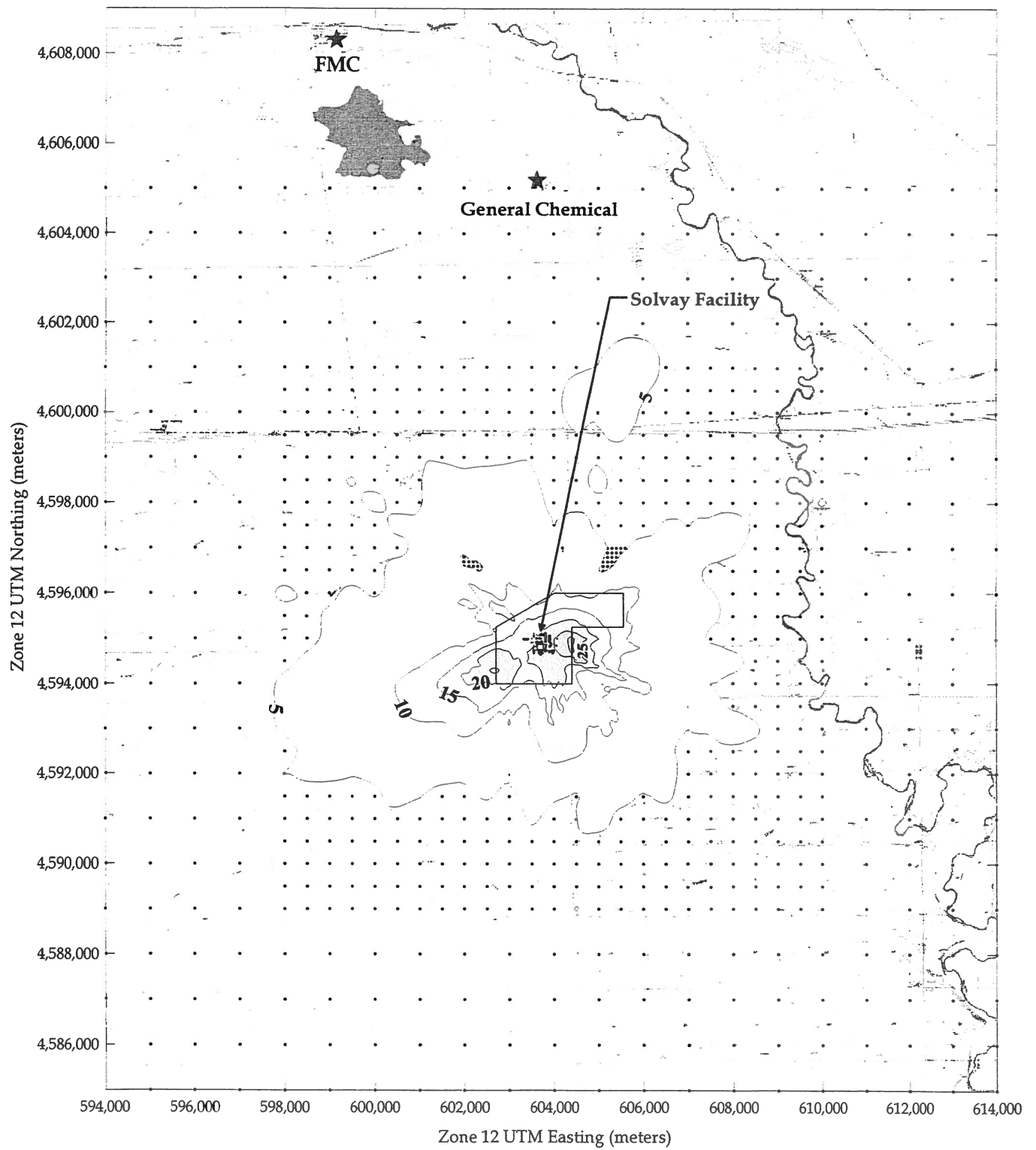
Figures 5.2 and 5.3 show the contours of the maximum annual and 24-hour concentrations around the facility. The locations of the two nearby facilities and the receptor grids used in this analysis are also presented. These figures show that the highest impacts are on the property line east of the facility and decrease with distance from the facility.

Figure 5.2: Maximum Annual PM₁₀ Impacts



Contour Units in $\mu\text{g}/\text{m}^3$

Figure 5.3: Maximum 24-Hour PM₁₀ Impacts



Contour Units in $\mu\text{g}/\text{m}^3$

5.4 Hazardous Air Pollutants Impact and Risk Assessment

An ambient impact assessment was performed to assess chronic human health impacts and cancer risks associated with hazardous air pollutants (HAPs) released from Source #17 (Source #100 HAP emissions are negligible and therefore not considered). Emission rates for a list of HAPs were estimated using the AP-42 emission factors (Tables 1.1-14 and 1.1-18). These HAPs were selected on the basis of their toxicity and known adverse human health effects. The selected HAPs, their EPA toxicity classification, AP-42 emission factors, and estimated emission rates are provided in Table 5.5. These emission factors are representative of the effluent downstream of boilers utilizing an Electrostatic Precipitator (ESP), which are assumed to be similar to the effluent downstream of the ESP on the Solvay furnace.

Table 5.5: Hazardous Air Pollutants Emissions and EPA Classification

HAP	EPA Classification ^a	AP-42 Emission		
		Factor (lb/ton – coal)	Estimated Emission	
			(lb/hr) ^b	(g/sec)
Arsenic	Group A	4.1×10^{-4}	8.1×10^{-3}	1.0×10^{-3}
Benzene	Group A	1.3×10^{-3}	2.6×10^{-2}	3.2×10^{-3}
Beryllium	Group B	2.1×10^{-5}	4.1×10^{-4}	5.2×10^{-5}
Ethylbenzene	Group D	9.4×10^{-5}	1.9×10^{-3}	2.3×10^{-4}
Formaldehyde	Group B	2.4×10^{-4}	4.7×10^{-3}	6.0×10^{-4}
Hexane	Group D	6.7×10^{-5}	1.3×10^{-3}	1.7×10^{-4}
Mercury	Group D	8.3×10^{-5}	1.6×10^{-3}	2.1×10^{-4}
Toluene	Group D	2.4×10^{-4}	4.7×10^{-3}	6.0×10^{-4}
Xylenes	Group D	3.7×10^{-5}	7.3×10^{-4}	9.2×10^{-5}

^a Group A – Human Carcinogen

Group B – Probable Human Carcinogen

Group D – Not Classifiable as to Human Carcinogenicity

^b Based on a coal consumption rate of 19.7 ton/hr

The maximum annual impact for each of the above HAPs was estimated using the ratio of maximum annual NO_x impact (µg/m³) to NO_x emission rate (g/sec) as follows:

$$C_{Ti} = Q_{Ti} \times \frac{C_{NOx}}{Q_{NOx}}$$

where:

C_{Ti} is concentration for toxin i (µg/m³)

C_{NOx} is NO_x concentration (µg/m³)

Q_{Ti} is emission rate for toxin i (g/sec)

Q_{NOx} is NO_x emission rate (g/sec)

The estimated maximum HAP impacts were compared with their respective chronic effect thresholds. In the case of known or probable carcinogens, where the cancer risk factors are available, the estimated maximum impacts were divided by their respective one-in-a-million risk factors to estimate the cancer risks associated with the HAP emissions based on a lifetime exposure. The impacts and the applicable chronic exposure thresholds and cancer risks are provided in Table 5.6. This table also lists the sources of the chronic exposure thresholds and cancer risk factors. Detailed calculations are provided in Appendix C on Sheet C.3.

As shown in Table 5.6, the estimated impacts were below the respective chronic effect thresholds for all of the listed HAPs. Therefore, none of these HAP releases from Source #17 pose a significant human health threat. Table 5.6 also shows that all of the estimated cancer risks are below the EPA acceptable one-in-a-million risk. Furthermore, the cumulative risk from Table 5.6 is 1.6×10^{-7} , which is also less than the EPA acceptable risk level.

Table 5.6: HAP Impacts Compared With Chronic Exposure Thresholds and Cancer Risk Factors

HAP	Estimated Maximum Impact ($\mu\text{g}/\text{m}^3$)	Chronic Exposure Threshold ^{d, e, f} ($\mu\text{g}/\text{m}^3$)	One-in-a-Million Cancer Risk Factor ^c ($\mu\text{g}/\text{m}^3$)	Source	Cancer Risk	Chronic Exposure Exceeded (Yes/No)
Arsenic	3.0×10^{-5}	5.0×10^{-2}	2.0×10^{-4}	IRIS	1.5×10^{-7}	No
Benzene	9.6×10^{-5}	60.0	0.13 to 0.45	CalEPA	7.4×10^{-10}	No
Beryllium	1.6×10^{-6}	2.0×10^{-2}	4.0×10^{-4}	IRIS	3.9×10^{-9}	No
Ethylbenzene	7.0×10^{-6}	1000.0	N/A	IRIS	N/A	No
Formaldehyde	1.8×10^{-5}	4.0	8.0×10^{-2}	ATSDR	2.2×10^{-10}	No
Hexane	5.0×10^{-6}	200.0	N/A	IRIS	N/A	No
Mercury	6.1×10^{-6}	3.0×10^{-1}	N/A	IRIS	N/A	No
Toluene	1.8×10^{-5}	400.0	N/A	IRIS	N/A	No
Xylenes	2.7×10^{-6}	400.0	N/A	ATSDR	N/A	No

^c EPA Air Toxics Website (<http://www.epa.gov/ttn/atw/hapindex.html>) and IRIS

^d EPA Integrated Risk Information System (IRIS), Reference Concentration (RfC)

^e California EPA (CalEPA), Chronic Reference Exposure Level

^f Agency for Toxic Substances and Disease Registry (ATSDR), Chronic Inhalation Minimal Risk Level (MRL)

CLASS I MODELING

6.1 Impact Thresholds

The Wyoming Chapter 6 Permitting Requirements, Section 2(c)(iii), require that impacts of any proposed facility not cause an exceedance of the Class I area increments. These increments are provided in Table 6.1. Moreover, the EPA has proposed (FR July 23, 1996, pp. 38,249 – 38,344) to allow for a demonstration of “insignificant impact,” which exempts a proposed facility from performing a full increment consumption analysis (Wyoming DEQ follows this procedure). The levels of “significant impact level” (SIL) for NO_x and PM₁₀ are also provided in Table 6.1.

Table 6.1: Class I Area PSD Increments and Modeling SIL Concentrations

Pollutant	Increment (µg/m ³)	SIL (µg/m ³)
NO _x - annual average	2.5	0.1
PM ₁₀ - annual average	4.0	0.2
PM ₁₀ - 24-hour maximum	8.0	0.3

The impacts on Air Quality Related Values (AQRVs) are also addressed. The United States Department of Agriculture (USDA) Forest Service (FS) has proposed a concern threshold for visual range (VR) and for acid neutralization capacity (ANC) of high-elevation lakes (http://www.fs.fed.us/r6/eq/natarm/r4/bridger_ct.htm). Impacts from the proposed Source #17 modification were compared to these thresholds. The threshold for visibility is a 5 percent change in beta extinction (β_{ext}) and the threshold for ANC of high-altitude Class I wilderness lakes is the larger of the following:

- a relative change of 10 percent in ANC (eq) relative to baseline
- an absolute change in lake alkalinity of 1 µeq/l

The following Class I Area impact analysis is performed according to the November 2002 “Class I Area Impact Analysis Protocol” modified by the February 10, 2003, Wyoming DEQ comments on that protocol. The analysis detail presented in those documents will not be repeated herein.

6.2 AQRV Baselines

6.2.1 Visual Range Natural Background

The AQRV impact analyses incorporate baseline values. The VR analysis was based on measured values representative of “natural background” in the Class I areas. The measured constituent data for Bridger/Fitzpatrick is provided in Table 6.2.

Table 6.2: Summary of Measured Background VR Parameters at the Bridger/Fitzpatrick IMPROVE Monitoring Site, 1988-1999

Season	Dry Hygroscopic (Mm ⁻¹)	Non-Hygroscopic (Mm ⁻¹)
Winter	0.81	1.96
Spring	1.99	3.41
Summer	1.91	6.10
Fall	1.40	3.60

The measured background VR values in Table 6.2 were calculated as follows. The data from 1988 to 2001 for the Interagency Monitoring of Protected Visual Environments (IMPROVE) site at Bridger/Fitzpatrick Wilderness (BRID1) were obtained from the IMPROVE website (<http://vista.cira.colostate.edu/improve>). Only data up to 1999 were included in the analysis, since the 2000 and 2001 data had not undergone the highest level of quality control. Background levels were calculated for non-hygroscopic and hygroscopic compounds separately. Per the Interagency Workgroup on Air Quality Modeling Phase 2 (IWAQM2, 1998), non-hygroscopic compounds include coarse particulate matter (PM₁₀-PM_{2.5}), elemental carbon, organic carbon, and soil particles; the hygroscopic compounds include ammonium nitrate and ammonium sulfate. Summaries were based on the seasons per the Federal Land Managers AQRV Work Group (FLAG, 2000), specifically winter (December, January, February), spring (March, April, May), summer (June, July, August), and fall (September, October, November). For each year-by-season combination the 20th-percentile value was calculated for the non-hygroscopic and hygroscopic β_{ext} values (units of Mm⁻¹). The background β_{ext} from 1988 through 1999 were calculated as the mean of the 20th-percentile values for each season. Only seasons with more than 50 percent of the data present were used in the analysis (Watson, 2002). Based on this criterion, the winter season in 1988 was excluded from the analysis.

6.2.2 Lake Acid Neutralization Capacity Baseline

Two parameters needed to be estimated to establish the baseline ANC: baseline lake alkalinity ($\mu\text{eq/l}$) and estimated annual precipitation (m). Baseline lake alkalinity was calculated as the 10th-percentile lake alkalinity values for six lakes in the region (FS, 2000). Data for the indicator lakes were provided by the USDA FS (FS, 2002) and are shown in Table 6.3. The lake elevations varied from 2,950 to 3,432 meters above sea level (m asl). The FS data set consisted of a time series of measurements of the baseline alkalinity, including duplicates, the number of which varied from year to year and lake to lake. The 10th-percentile values were calculated from the entire data set, covering up to an 18-year record (Table 6.3). Blanks and negative values were excluded from the calculation. Note that the Upper Frozen Lake was recently added to the set of "indicator lakes." Data collection at this lake began in 1997, and to date there have been four samplings: one day per year in July or August for 1997, 1999, 2000, and 2001. For two of the samplings, a duplicate was also collected, making a total of six available readings with a range of